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USSR Report

ECONOMIC AFFAIRS

(FOUO 15/80)



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ECONOMIC POLICY, ORGANIZATION, AND MANAGEMENT

KHACHATUROV DISCUSSES ECONOMIC GROWTH

Moscow VOPROSY EKONOMIKI in Russian No 7, Jul 80 pp 3-16

[Article by Academician T. Khachaturov: "Effectiveness of Socialist Public Production"]

[Text] Boosting the efficiency of public production constitutes a law of economic growth under socialism, realized in accordance with the improvement of socialist social relations and their transformation into communist relations. At the June (1980) Plenum of the CPSU Central Committee, L.I. Brezhnev said: "We set ourselves such a capital task as boosting efficiency of production and quality of work... It is necessary to think further as to how to speed up scientific-technical progress, strengthen labor and state discipline and provide for sure growth of labor productivity."

Economic effectiveness of public production reflects the planned interdependence of expenditures of public labor put into production and the obtaining by society from this of economic and social gains, that is, an end result in the form of material benefits and services as well as intellectual values needed by society for its existence and development. Effectiveness as a relation between expenditures and results constitutes at the same time a resultant, synthetic qualitative indicator of the country's economic development and of the raising of the people's well-being.

Economic effectiveness is closely connected with social effectiveness. Marxism-Leninism teaches that at the basis of social development there is to be found growth of material production. Development of socialist production increases the possibilities of accumulation and consumption and creates conditions for social progress and for raising the level of culture, education, health care, which in its turn promotes higher labor productivity and production growth.

The socialist system of economy is characterized by material and social conditions determining the possibility and need of raising the efficiency of public production. The employment of these conditions constitutes one of the most important tasks of USSR economic development at the stage of mature social and the further building of communism over the long term.

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First and foremost, the powerful production potential created in the years of socialist construction, which is still not being used fully, applies to the material conditions of raising efficiency. This production potential includes the numerous qualified cadres of workers that have come into existence in these years as the basic productive force of society. At the outset of 1980 140 million persons had full and incomplete higher and secondary education in the USSR, that is, 80 percent of the employed population; these included 14.8 million persons with completed higher education. The number of scientific personnel had reached 1.3 million persons by 1980. The bigger the number of cadres and the higher their qualifications, awareness and discipline, the higher the efficiency of production.

Another very important element of the production potential and a factor in the boosting of the efficiency of socialist production is to be found in producer goods, constituting at the present level a material-technical base of developed socialism. By 1980, fixed production capital had increased fifteenfold compared to 1940, including twenty-twofold for industry, ninefold for agriculture (including livestock), twelvefold for transport and communications and fifty-sevenfold for construction. Technical progress has exerted an influence on modernization of fixed capital, improvement and restructuring of production (powder metallurgy, fast-neutron reactors, microelectronics, shuttleless weaving and nonwoven fabrics). Further successes of technical progress and its unlimited possibilities will provide for higher labor productivity and improvement of its conditions.

Of major significance for the development of socialist production and boosting of its efficiency are favorable natural conditions in the Soviet Union and its tremendous reserves of minerals, expanses of fertile land, profusion of fresh water and vast forests. This natural wealth can and must be used increasingly fully and rationally.

Together with the production potential, an ever-increasing role in economic and social development is being played by the nonproduction potential, which determines the conditions of the life and culture of workers and exerts a reverse action on economic growth. The nonproduction potential consists of cadres of workers of the nonproduction sphere and its material base--residential buildings, municipal services, consumer enterprises and organizations, also those of trade and supply, educational institutions, health-care institutions, sports, art and science institutions as well as the intellectual assets accumulated through the centuries--knowledge, experience and culture. All of these are important factors of social and also of economic development.

Raising the efficiency of public production requires the creation of certain social conditions. A decisive role is played by the fact that socialist ownership of the means of production determines the planned character of development of the economy and planning of the national economy. With economic growth, requirements are increased on planning and on the entire economic mechanism for the purpose of having it influence more the boosting

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of production efficiency. These new requirements at the stage of developed socialism are connected to the tremendous growth of production volume, improvement and increasingly complex character of production equipment; economic ties are becoming increasingly interdependent and ramified. The decree of the CPSU Central Committee and the USSR Council of Ministers of 12 July 1979 provides for improvement of planning and the expansion of its range to 10-20 years, ensuring of proportionality and stability of plans, especially five-year plans and the development of a complex approach to planning. Economic and moral incentives for boosting production efficiency are becoming increasingly necessary. At the same time, many demands are being made on the system of cost accounting, economic factors and stimuli, which should increasingly effect the growth of labor productivity and fuller utilization of the material prerequisites for raising efficiency. An important role is played here by the steady rise of the workers' living standard, the strengthening and development of the socialist way of life, which contributes to the growth of labor productivity and more skilled management of the economy at all of its levels.

The material and social prerequisites determining a rise in the efficiency of public production must be fully utilized. This is a root problem of USSR economic development at the stage of mature socialism and in the perspective of transition to communism, when the economic potential is becoming increasingly powerful and the material-technical base increasingly productive. With curtailed possibilities of extensive growth, the consequence of a constantly reduced involvement of new manpower and new natural resources in production, rising efficiency of production from the use of the advantages of the socialist system of economy and its growing economic potential constitute a condition for the acceleration of the rate of economic development.

Rising efficiency and expanding volume of production require all-out, many-sided intensification and increasingly fuller use of all factors of economic growth. This means first of all growth of labor productivity. The founders of Marxism-Leninism have always attached major importance to it. The higher labor productivity, the higher the volume of production and the level of the people's well-being and the greater the possibility of using the combined time of workers not only for production of the means of existence but also for the all-round development of the individual and raising of the level of science and culture. "A country is richer," K. Marx wrote, "when the productive population is smaller than the nonproductive, while the quantity of products remains the same."¹ This is possible only through growth of labor productivity in material production and subsequently in the nonmaterial sphere. Raising of the productivity of socialized labor serves as an

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important indicator of efficiency growth of public production. Lenin's thesis is widely known: "Labor productivity is... most important and what really matters for victory of the new social order."²

The right use of a number of factors exerts an influence on the rise of labor productivity. Factorial analysis of labor productivity shows that the main role in raising it is played by the technical level of production (means of labor objects of labor and technology). Growth of labor productivity in large measure (60-70 percent) depends on raising this level.

The provision of workers with advanced means of labor finds its reflection in a raising of the capital-labor ratio, that is, the value of fixed capital per worker. Growth of the capital-labor ratio is a factor in the growth of labor productivity; at the present time, growth of the capital-labor ratio in most of the sectors of the national economy is catching up in varying degree with growth of labor productivity, as borne out by the following data for 1940-1978 (1940 = 100).

	Growth of capital-labor ratio	Growth of productiv- ity
Industry	742	732
Agriculture	978	420
Transport and communications	389	387
Construction	952	625

The figures show that in industry, transport and communications labor productivity has grown almost to the same extent as the capital-labor ratio. In agriculture, where a transition has taken place to large-scale production of the industrial type in the decisive sectors, the capital-labor ratio has grown particularly sharply, but its absolute level was half that in industry (respectively, 7,900 rubles and 13,300 rubles per worker). This has affected growth of productivity, which was smaller than in industry. In construction, where the capital-labor ratio has also grown quickly, it has remained much smaller than in industry (4,400 rubles per worker), which has also influenced the lag in growth of productivity.

Together with the capital-labor ratio, serving as a value indicator (funds are shown in value terms), the use of physical indicators of the technical capital-labor ratio is practicable. Examples of such indicators are electric power-worker ratio, power-labor ratio, machine-worker ratio and so on. Statistical data show that during 1940-1978 growth of the capital-labor

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ratio frequently corresponded to the growth of its physical indicators. Thus, the electric power-worker ratio in industry increased by a factor of 7.1 during 1940-1978, the power-worker ratio in industry by a factor of 6.9 and in agriculture by a factor of 14.2.

A major role in increased labor productivity is played by intensification of production, which proposes improved use of objects of labor, raw and other materials and reduction of losses. About three-quarters of the cost of industrial production is attributed to material expenditures. Calculations show the possibility of obtaining at the present time a fuel and power economy of 10-15 or more percent, sharply reducing metal losses in machine-building and metalworking, where 22 percent of ferrous metal is expended in the form of shavings, filings and fumes, while all metal wastes, including corrosion and wear, exceed 30 million tons per year. Big wastes and losses occur also in other sectors of industry, agriculture, construction, transport and trade. For the purpose of boosting preservation of products and having them reach the consumer, we need the development of the infrastructure of agriculture, erection of warehouses, elevators and other storage facilities not only in places of consumption but also among producers, at sovkhoses and kolkhoses, as well as the construction of roads and enterprises for initial processing of agricultural products.

Equipment load has to be increased for the purpose of better use of production resources. Judging by the weighted mean annual number of hours of operation of electric motors in industry, comprising only one-sixth of the yearly calendar number of hours, equipment load can be significantly increased through the wide-scale introduction of charts and boosting of the smooth flow of uninterrupted supplying of raw and other materials and power. The study of production capacities of enterprises and bringing capacities of equipment for individual shops into accord with stages of the production process can be of big value.

Intensification of production presupposes the curtailment of excessively long periods of development and introduction of scientific achievements. This entire process from the scientific laboratory through planning, the experimental base right up to production has to be reduced to the utmost degree; this requires increasing accountability in all parts of development and adoption, improvement of the planning of this process and a high level of material motivation in reducing the time periods of development and adoption of new equipment.

All production processes and newly introduced equipment must be planned to provide highest efficiency of production processes, which is achieved with complex utilization of raw and other materials, curtailment or complete cessation of setting aside of harmful wastes through their use and introduction of near waste-free or waste-free production. This requires extra expenditures and increases both capital investment and production cost. During the course of introduction of new equipment, expenditures grow at first and then begin to become smaller with their mastery.

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Thus, numerous possibilities exist for increasing the intensiveness of all factors of economic growth and thereby the solution of the basic problem of USSR economic development at the present stage and in the future. Comprehensive intensification is a necessary means of boosting the rate of economic growth and social development of society.

Increase in the rate of economic growth constitutes an important indicator of efficiency of public production. But it is not enough to measure it solely by this indicator. Growth rates cannot be evaluated in isolation from levels and volume of production. In low volume, its insignificant absolute increases ensure a high growth rate. With a large volume of production, even a significant absolute increase provides only a small growth. This is to be explained in some degree by the fact that growth rates were very high in the early stages of socialist construction, but in subsequent years they began to get smaller. In the Seventh Five-Year Plan, the mean annual growth rate of gross industrial production was 8.6 percent and in the Tenth (four past years--4.7 percent, but the absolute growth of gross production in the Seventh Five-Year Plan on an average for a year equaled 14.4 billion rubles, while in the Tenth Five-Year Plan the figure was 21.2 billion rubles. Nonetheless the existence of reserves in the national economy shows that it is quite possible to boost growth rates through their use.

The rate of economic growth in itself does not reflect and cannot reflect fullness of the use of the production potential and all resources and possibilities of economic and social development. For comparison of the effect with existing resources, it is necessary to establish a correlation between the obtained effect in the national economy as a whole, in its parts and individual enterprises and the expenditures required for this. Calculations of the relation between the effect and expenditures make it possible to correctly choose directions of development and to ensure the most favorable (optimal) relation. This means that the maximum possible effect is achieved with minimally possible expenditures. There is required precise formulation of tasks, when in the course of this period the given effect should be achieved, as, for example, at the end of a projected period of 10-15-20 years, or as a sum for all these years, or in the course of the immediate year ahead. The magnitude of expenditures depends on this. The smallest expenditures require the attainment of the optimum toward the end of the accounting period, the biggest through the obtaining of an optimum in each given year. With growth of production, increasingly greater possibilities are opened for achieving an optimum in the course of a constantly shorter period.

At the present time, it is customary to measure the size of the effect of socialist production by the volume of the national income as the most generalized indicator. At the same time, we have in mind that the material structure of the national income and its distribution between the accumulation fund and the consumption fund are optimal and correspond to the social needs for it and that all production benefits are needed by society and will be used by it. This means at the same time that the production of unnecessary or unused benefits does not boost the national income.

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In addition to this, the importance of the social effect consists of the fact that investments into the nonproduction sphere also yield an economic return and exert thereby an influence on the development of the production sphere. Investment in education contribute to the creation of new equipment and its mastery in production, improvement of the organization of production and higher labor productivity. Investment in health care, solving an important social task--improving the people's health, also have a positive influence on raising labor productivity, reducing interruptions in work on account of illness and increasing working capacity. Development of the service sphere, improvement of supply and trade make easier the labor of people, especially women, reduce nonproductive losses of time, increase the possibilities of boosting qualifications, education of children and increase working capacity. Material conditions of the life of workers: conveniences of housing, transport and the like are of major importance in growth of productivity of socialized labor. Scientific development plays a significant role. All this shows that the nonproductive sphere provides a social effect which in a number of cases can be evaluated economically. The social effect in its turn provides a secondary economic effect, influencing the result of socialist production as a whole.

Thus, the size of the national income and its growth reflect not only an economic but also a social effect, although they may not coincide in time. For example, outlays on education and improvement of housing exert an influence on raising labor productivity after the expiration of a certain time.

For obtaining relative indicators of the economic effectiveness of socialist production, the annual volume of national income needs to be compared with outlays required for its production. Sometimes national income is compared with the quantity of producer goods. At the same time, it is necessary to take into account a time lag, as the effect of capital investments or increase of capital are not immediately felt and pass through a period of assimilation of the introduced capital, occasionally continuing for 3-5 years. In other words, the size of fixed production capital should be determined at an earlier date than the volume of the national income. The lag calculated with the use of mathematical statistics (correlation coefficient) amounts to 1-3 years. For this reason the national income produced in 1979 (438 billion rubles) has to be compared with producer goods at the end of 1977, which include fixed production capital (932 billion rubles) and working capital in reserves of commodity stocks in current prices (269 million rubles) and a total of 1,201 billion rubles. For 1979, the ratio $438 \times 10^9 : 1,201 \times 10^9$, called the output-capital ratio of the national income, consisted of 0.36 ruble per ruble of capital.

For the solution of the question of effectiveness of public production, it is not enough to have the indicator of the output-capital ratio, that is, a comparison of the national income with producer goods. First, of important significance for economic growth are not only producer but also nonproducer goods, although the latter exert not a direct but only an indirect influence. With the inclusion of nonproducer goods, the total sum

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of fixed and working capital at the end of 1977 amounted to 1,706 billion rubles, while the output-capital ratio was 26 kopecks per ruble. Second, production of the effect--national income--depends first of all on outlays of live labor. It in particular, equipped in one degree or another with the means of labor, creates the product and serves as a decisive effectiveness factor. For this reason, the size of current outlays for the creation of the product are of great importance. Reduction of these outlays is usually repaid in a fixed period by an increase in outlays for the production of capital. Consequently, the obtained effect must apply not only to capital and to one-time outlays for their creation but also to current outlays of labor for production of the product.

In 1970, with an economy of outlays for commodity production of industry of 3.7 billion rubles and with capital investment in industry amounting to 29 billion rubles, $3.7:29=0.128$ ruble of economy applied to each ruble of this capital investment. In 1975, with an economy of 3.6 billion rubles and capital investment of 40 billion rubles, there was only 0.09 ruble of economy per ruble of capital investment; in 1978, these figures respectively amounted to 2.3 billion rubles, 46 billion rubles and 0.05 ruble of economy.

In regard to other sectors of the national economy, in recent years, reduction of production cost has not been observed in any one of them. In transport and construction there has been an insignificant growth in production cost and in agriculture--a significant growth (of 20-30 and more percent) during 1970-1979, which is connected with mechanization and growth of the capital-labor ratio in agriculture.

The reasons for the small reduction or even an increase in production cost in separate sectors of the national economy are basically the same as for reduction of the output-capital ratio. These reasons are capable of being completely eliminated. Taking into account possible savings in production cost, it becomes necessary to achieve higher efficiency of public production, which is quite achievable for a developed socialist economy.

There exists a point of view according to which effectiveness does not constitute a relation of effect to outlays. Some economists (M. Bor, N. Yakunina) believe that in the determination of effectiveness it is possible to restrict oneself to data on production growth. But it is by no means a matter of indifference as to what price must be paid for acceleration of economic growth and a higher rate of increasing production--through better utilization of resources, more rational organization of production, work according to schedule or through overtaxing of manpower, "crash" work, overexpenditure of natural resources and the like. The opinion is given (A. Kats) that in raising the question: "what price," it is not necessary to compare the effect with outlays, but it is necessary to implement measures for raising the technical level and only then will the maximum effect be provided.

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The argument may be presented against such a formulation of the question that there are simply not enough funds for carrying out such measures at the given moment, since society's resources are limited at each stage of development. Hence the question inevitably arises as to what measures should be first undertaken and which ones--second and so on. The solution of this question is connected to the size of resources possessed by society and to needed outlays for individual measures. It is necessary to determine the effect that can be obtained from each measure and the expenditures required. This means that we are required to calculate the effectiveness of each measure and to compare the total effect on the national economy that would be produced from implementation of the total aggregation of the outlined measures with the total resources of the national economy.

Big outlays in regard to effect inevitably result in subsequent reduction of the growth rate of production.

Another point of view, which is also held by the author, consists in acknowledging the need for a comparison of effect with expenditures. In this connection, there naturally should be chosen those indicators which correctly reflect effect and expenditures. Frequently, the net product $v + m$ is taken as effect (on the scale of society--national income) and the gross industrial product $c + v + m$ as expenditures; the formula then looks like $\frac{v+m}{c+v+m}$.

This relation essentially characterizes the relative share of the national income in the gross social product. It may increase if the productivity of live labor grows faster than the decrease in materials intensiveness and capital-output ratio of production, that is, if there is a relative increase of the relative share of living labor in the cost of production. Such a correlation is possible if outlays of past labor decrease faster than outlays of live labor. But, as a rule, the reverse takes place in the process of development of production--with a general reduction of outlays of labor per unit of production, the share of live labor decreases faster than the share of past labor. This constitutes the main idea of technical progress, which is aimed at the replacement of live labor by past labor. For this reason the above-mentioned formula cannot serve as an indicator of the rise in efficiency of production. The expression $c + v + m$, as we know, was widely used by the founders of Marxism-Leninism and other authors in the study of both the dynamics and structure of public production. But for the computation of the quantitative relation between effect and expenditures, this expression does not provide a correct answer, inasmuch as a summation by stages of the production process yields an exaggerated size of outlays as a consequence of repeated counting, while, on the other hand, a significant part of initial expenditures in the creation of producer goods is not taken into account.

Actually, first, in the determination of gross production of an association of enterprises, sector or national economy according to the plant method, a repeated count of fuel, power, raw and other materials and parts is inevitable. If a product undergoes successive stages of processing at several

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enterprises, the same outlays are included at each enterprise on a repetitive basis in the production price. If materials intensiveness increases for different reasons, production growth could be fictitious. It is clear that the elimination of multiple counting of one and the same amounts requires taking into account only the value added by the processing at each of these stages; it has to include the value of outlays of live labor, that is, the net product designated by $v + m$ and amortization a . This sum of expenditures comprises the cost of the produced end product.

Second, the first term of the expression $c + v + m$ includes only the carried over cost in the form of amortization, raw and other materials, fuel and power. But this is not the full amount of the advanced fixed and working capital needed for production of the product. In other words c includes that which under the conditions of capitalism K. Marx called consumed capital rather than employed capital. Without provision of its full magnitude, production cannot operate, although employed capital is included only partially in the value of the product in proportion to the wear of fixed resources and carry over of the cost of working capital expended on the produced product.

In connection with what has been said in the determination of outlays needed for production of the effect, first, it is necessary to avoid multiple inclusion of one and the same amounts in order to obtain the actual rather than an exaggerated size of expenditures. Second, it is necessary to take into account not only current expenditures of production but also expenditures in the form of investments into producer goods--fixed and working capital. Third, the time lag between outlays and obtaining of the effect must be taken into account.

Outlays of live labor must be fully taken into account at all stages of material production. The opinion exists that there should be included under outlays of live labor ostensibly only the labor outlays that are required and consequently in the expression of outlays of labor in value form one can restrict oneself to data on the wage fund (with additional sums [nachisleniya] or without them). This, of course, is incorrect--outlays of labor have to be taken in full. It is possible only in this way to determine what the product costs society rather than an individual enterprise.

Full outlays of live labor may be expressed in man-hours of expended labor reduced to the basic. For general calculation, labor outlays can be expressed with a certain approximation as the sum of wages and all primary earnings of workers in the material sphere plus the additional product. It is possible to determine in this way full outlays of live labor in cost form at all stages of production beginning with the initial product-acquisition of raw materials, fuel, production of electric power and further the output of the intermediary product--construction materials, components and parts, pipe, paints and other materials and semifinished products going into the further processing and finally the fabrication of the end product--objects of consumption and means of labor intended for use in production.

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The size of the additional product for the national economy as a whole can be determined on the basis of data of the intersectorial balance in the ratio $m:v$, which, according to the intersectorial balance of 1972 was about 1, that is, the additional product was equal to the required. In other words, outlays of required labor have to be doubled in order to obtain full outlays of labor. With such an approach, the entire mass of live labor in material production will not contain a double count. Subsequently there should be taken into account wear of fixed capital, taking the sum of expenditures on amortization at all stages of production--initial, intermediary and end product. Here also double count is eliminated. It is necessary only to consider that these outlays could be somewhat reduced as the result of excessively prolonged normative and actual service life of fixed capital.

The question arises: in this connection, are outlays for raw and other materials, fuel and power taken into account? Outlays for the procurement of the initial product--raw materials and fuel--are already included in outlays of live labor at mines, pits and oil fields as well as in outlays for the amortization of the equipment used here and in outlays for production of electric power for putting equipment into operation. The latter consist in their turn of outlays of live labor, amortization of equipment and expenditures for the procurement of fuel. Outlays for the transporting of fuel are also included in outlays of live labor and in outlays for amortization, fuel and power for moving trains, motor vehicles and vessels. A similar situation exists in regard to outlays for the remaining forms of materials. In regard to the intermediary product, that is, semifinished products, outlays for its production are taken into account in outlays of live labor and amortization added as the result of the processing of raw and other materials. The same applies to the end product.

Thus, at each stage of production, account is taken only of added outlays of labor, which are reduced to full outlays of live labor and in regard to the part of past labor--only to amortization. Such a one-time accounting of actual expenditures corresponds to the new manner of measuring production volume for net (normative) production provided for by the decree of the CPSU Central Committee and USSR Council of Ministers of 12 July 1979.

Subsequently, it is necessary to compute the expenditures which could fail to be considered in a given year (for example, raw and other materials as well as other means of production acquired and released in the preceding year but not transferred to the given year). Their cost must be added to expenditures of the given year. And conversely, there must be excluded from them outlays for the means of production that are transferred for use in the coming year.

It follows from what has been said that with such a "cleansing" of gross expenditures of the given year from repeated (or multiple) counting or, in other words, with a single counting of expenditures at all stages of production there is obtained a quantity that corresponds to the cost of the end product. This is net production (national income) plus amortization, that is, $v + m + a$, or the end product.

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The question arises: is it justifiable for the same value $v + m$, that is, the national income, to appear both in the numerator and in the denominator?

This question must be answered in the affirmative--the net product included in the numerator is equal to the outlay of live labor in the denominator. Some economists propose reckon in the numerator and in the denominator in different prices; for example, in the numerator--in comparable prices in order to express the national income in physical volume and to take into account the influence of growth of labor productivity and in the denominator--on the basis of cost in accordance with the size of outlays of live labor.³ This provides the possibility of taking into account growth of the physical volume of production per unit of expenditure of live labor. But, if the outlays of live labor are computed on the basis of cost, then the other forms of expenditures should also be determined according to cost rather than on the basis of prices.⁴ As for the time lag between outlays and production of the effect, according to some calculations (V. Shikhova), this lag is set at three years on the basis of use of the correlation coefficient.⁵

Real expenditures, as has been noted, are not restricted only to the sum of live labor and amortization. All producer goods are a factor in production growth; without them, production, either in the form of the gross product or national income in its cost or physical volume, could not have taken place. For this reason, the obtained effect should be attributed solely to current expenditures but also to one-time outlays (to existing capital created throughout the entire preceding period). But they simply cannot be summated with current outlays due to the varying time of their turnover and actually different dimensionality. There is a need for discontinuing existing fixed and working producer goods in accordance with the adopted norm of effectiveness (0.12).⁶

The norm of effectiveness is determined on the basis of the repayment time of the least effective of the implemented measures ("closing" in terms of the level of effectiveness) through economies from reduction of current expenditures due to their implementation. If, for example, it is proposed to carry out investments with a repayment time of up to 8 years (or less), it would then mean that the norm of effectiveness would be equal to $100:8 = 12.5$ percent.⁷

The above-described approach for determination of the output-capital ratio indicator as including outlays of live labor under cited expenditures for the end product was proposed by us in a report at the International Conference on Theoretical and Methodological Problems of Boosting Efficiency of Socialist Public Production in Moscow in November 1974.

By one-time expenditures for the formation of production fixed and working capital we mean accumulated expenditures in such capital, that is, its full restorative cost (and not just investment of a given year). By working capital in production we mean both stocks of material working capital and

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also monetary working capital and all other forms of working capital. In particular, expenditures must be determined for the formation of an advance fund for wages with account being taken of the turnover time of production which elapses from the start of production to the obtaining of funds from the sale of finished production. According to data of the USSR Central Statistical Administration, the average turnover time of working capital as a whole in industry was 66.9 days in 1974. Such an average time from the moment of allocation of funds for the formation of production reserves to the time of restoration these funds with the cost of the sold products. During this time, the enterprise is obliged to pay wages four times to workers and employees not to speak of the fact that it must pay to Stroybank several times amortization deductions and make payments for capital and net surpluses of profits. Of course, there must be taken into account at the same time the transitory indebtedness of the enterprise to workers and employees in regard to wages. Outlays for the formation of this advanced fund may vary for sectors and enterprises depending on the length of turnover of working capital.

We shall indicate production fixed capital by ϕ_{fix} , working capital-- ϕ_{work} and other-- ϕ_{oth} . Then the total amount of employed advanced capital is $\phi = \phi_{fix} + \phi_{work} + \phi_{oth}$. Following reduction of this quantity to the annual size we obtain $E(\phi_{fix} + \phi_{work} + \phi_{oth})$ or $E\phi$.

What does this quantity represent? Let us assume that that amount would have to be annually deposited in the bank if the fixed and working capital needed for making an enterprise operational had been obtained from the bank on the basis of yearly repayment and payment of interest for obtained credit, for example, of 12 percent (norm of effectiveness in conformity with the Standard Procedure for Determination of the Effectiveness of Capital Investments).

Now all the necessary components are available for the compilation of the formula for computing effectiveness of public production:

$$\gamma = \frac{v_1 + m_1}{v_0 + m_0 + a_0 + E\phi}.$$

where $\phi = \phi_{fix} + \phi_{work} + \phi_{oth}$, $v_1 + m_1$ constitute the value produced by live labor for the reporting year and $v_0 + m_0$ would be the same for the preceding year.

Effectiveness γ will increase if the sum $v_1 + m_1$ in the numerator will grow faster than $v_0 + m_0 + a_0 + E$ in the denominator.

In the given formula, the effect, equal to the obtained national income, relates to the real size of expenditures of society on the production of products without a double count, but with the inclusion of interest for repayment of advanced fixed and working capital.

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Let us put in the formula presented above the following statistical data: national income (1979) $v_1+m_1 = 438$ billion rubles, ditto (1978) $v_0+m_0 = 426$ billion rubles, amortization (1978, excluding capital repairs) = 37 billion rubles. Fixed production capital at the end of 1977 was equal to 932 billion rubles, working capital in reserves of commodity stocks--269 billion rubles, fund for wage payments--38 billion rubles, total sum of capital--1,239 billion rubles. With a norm of effectiveness of 0.12, the capital, reduced to annual size, equals 148 billion rubles. The indicator of effectiveness will amount to on the basis of these data:

$$\frac{438}{462+37+0.12 \times 1,239} = \frac{438}{619} = 0.72.$$

The calculation of effectiveness of socialist production in accordance with the presented formula is provided at the national-economic level, since the formula includes resultant national-economic quantities. But the corresponding values are dependent on their components, that is, on the indicators of individual elements of the national economy, sectors, associations and enterprises. Thus, the national income is made up of the sum of the net production of all sectors of material production and the associations and enterprises belonging to them. Fixed capital, material working capital and the wage fund for the national economy likewise consist of corresponding amounts for each component.

When deriving indicators of effectiveness for each individual component, there should be taken into account significant differences in prices and wages as a consequence of which the obtained indicators can only approximately reflect the effectiveness of each given component.

Computation according to the above-presented formula does not lay claim to absolute accuracy. This is to be explained in part by the fact that the initial values do not fully meet the aims of the calculation. In our opinion, statistical organs are in a position to provide accurate recording of the necessary data for determining actual yearly outlays of social labor, which could be compared with the effect obtained from them in the form of the national income. In particular, it would be important to organize in addition to the existing reckoning of gross production according to the plant method the calculation of net or conditionally net production, determining for each enterprise the value added by processing. Boosting the effectiveness of socialist production is in conformance with law for the planned socialist economy where the national income grows faster than the capital funds.

This means that in the expression $\mathfrak{D} = \frac{A}{P+EQ}$, where A is the national income, P --current outlays, E --the norm of effectiveness and Q --the capital funds, the denominator must increase slower than the numerator. So far our production capital has been growing faster than the national income. But the possibility does exist of acceleration of the growth rate of national income. The national economy possesses big reserves for the solution of this task.

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An important indicator of the effectiveness of public production is the relation of the consumption fund in the national income to the accumulation fund. The greater the volume of consumption per unit of accumulation, the higher the efficiency of public production. When comparing consumption with accumulation there should be added to consumption volume nonproduction accumulation, a large part of which consists of capital investment into residential buildings, institutions of education, health care, science, art and culture as well as consumer services. Indicators of the correlation of funds of the national income, consumption and accumulation are presented for different years in the following table.

	1960	1965	1970	1975
Growth of fixed production capital for the year (in billions of rubles)	15.7	17.5	32.1	38.8
Ditto in percentage of use of national income	11.0	9.2	11.3	10.7
Growth of production fixed capital and material working capital and reserves (in billions of rubles)	28.7	39.8	65.2	73.4
Ditto in percentage of use of national income	20.1	20.9	22.9	20.3
Used national income per ruble of accumulation (in rubles)	3.73	3.79	3.39	3.78
Used national income per ruble of production accumulation (in rubles)	4.98	4.79	4.38	4.94
Consumption per ruble of accumulation (in rubles)	2.73	2.79	2.39	2.78
Consumption plus growth of nonproduction fixed capital per ruble of production accumulation	3.98	3.79	3.38	3.94

The figures presented in the table attest to the fact that for a number of years comparative indicators of consumption and accumulation during growth of absolute indicators remain approximately at the same level. This indicates that considerable reserves for boosting of efficiency of public production have still not been put to use.

In addition to the presented indicators of effectiveness of public production growth indicators may also be used--the ratio of growth of the national income to growth of producer goods or the ratio of growth of consumption to growth of accumulation. These indicators distinctly to individual features of its dynamics on the basis of years. But they are distinguished by big variability in time--much more than the "total" indicator and demand most exhaustive analysis, particularly when establishing a lag between growth of national income and the outlays responsible for this growth.

In conclusion, there should be emphasized the importance of analysis of factors behind the dynamics of public production in which workers of material production are engaged who are provided with fixed and working production capital, which determines the productivity of their labor. Of course,

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production capital by no means operates independently as stated by the bourgeois "three factor theory"; by themselves, capital funds do not create value, but the volume of production output and its growth depend on the existence of capital funds, their technical level and the degree of their mastery by workers.

There should be added to this the system of production control, natural resources and certain other factors that can affect volume of production. Their analysis is of big importance in the study of effectiveness of public production. It is not just a matter of comparing figures, data and their dynamics but by what means these or those conditions, depending or not depending on people, influence the development of production. Such factors as growth of the cultural level and education of people, the progress of science and technology, availability of natural resources to the country and their accessibility play an important role in the development of production and in boosting the effectiveness of public labor directed at the achievement of the aims set by society.

FOOTNOTES

1. K. Marx and F. Engels, "Sochineniya" [Works], Vol 26, Part 1, p 215.
2. V.I. Lenin, "Polnoye sobraniye sochineniy" [Complete Works], Vol 39, p 21.
3. The calculation of outlays of live labor by means of deduction of its growth due to increased labor productivity from the volume of national income was done by V. Medvedev on the basis of data for 1960-1974. According to the series he obtained with a 2.5-fold increase in the national income in comparable prices for 1960-1976, outlays of live labor increased only by a factor of 1.33. We may add to this that an increase in outlays of live labor may be judged by the number of persons employed in material production. According to data of the USSR Statistical Administration, the number of persons employed during 1960-1974 grew by a factor of 1.25. The difference is not great, which confirms the calculation made by V. Medvedev. But if outlays of live labor be considered on the basis of value, then combining with them other elements of current outlays in existing prices would be wrong--they should also be recalculated on the basis of value, inasmuch as the size of one-time outlays is reduced to current ones without speaking of the fact that the addition of material outlays results in repeated counting (see V.A. Medvedev, "Sotsialisticheskoye proizvodstvo" [Socialist Production]. Izdatel'stvo "Ekonomika", 1976, pp 143-146).
4. Calculation of labor outlays in value form according to different prices in the numerator and in the denominator was proposed by us in 1975 (see "On Criteria and Indicators of Effectiveness of Public Production"--KOMMUNIST, No 7, 1975).

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5. It was proposed in the aforesaid article in KOMMUNIST to assume this lag to be equal to one year and the effect in the given year was proposed to be attributed to outlays of the preceding year.
6. Sometimes the question is raised: what is the economic sense of putting presented outlays in percentage form? The fact is that there must be included in full outlays for production, as indicated above, not only current outlays of production and profit (that is, $c+v+m$) but also advanced initial outlays for the creation of production capital. The opinion that these advanced outlays are reflected in amortization included in current expenditures cannot be accepted, since amortization reflects only a small paid off part of fixed capital and not the entire volume of employed capital. It is clear that to add to current, for example, annual (or monthly, or daily) expenditures of production the entire sum of advanced initial outlays would be wrong because of the varying dimension of these amounts. In reducing to a single dimension it would be necessary either to integrate with advanced capital the entire volume of current outlays for the entire time of turnover of advanced capital, let us say for 10 years, or reduce advanced capital to an annual size, basing oneself on the time of capital turnover (that is, of the time of their loan). The time of turnover of capital (6.7, 8.3 or 10 years) corresponds (reciprocal) to 15, 12 and 10 percent of the reduction [privedeniye]. A turnover time of 6.7 years is manifestly small; therefore 15 percent is excessively large, and 12 or even 10 percent should be used. In accordance with the time of capital turnover, the standardized times of repayment of capital investments are 6.7, 8.3 and 10 years. These are not average but maximal magnitudes. They signify the maximal permissible time of repayment (or conversely--minimal permissible interest).
7. A norm of 0.12 was proposed for calculations of comparative effectiveness. It would be possible to argue whether this norm is suitable in the given case. No approved norm of absolute effectiveness exists. The ratio of average annual growth of the national income in the Ninth Five-Year Plan (14.4 billion rubles) to the average annual growth of fixed and working production capital (65 billion rubles) amounted to 22 percent and to average annual capital investment (without growth of working capital--98.6 billion rubles)--about 15 percent. If, however, growth of working capital is excluded, then this percentage will decrease even more. It is necessary to take into account the fact that this norm shows the bottom limit, with there being no upper limit: the higher the absolute effectiveness, the better.

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INTRODUCTION OF NEW TECHNOLOGY

BETTER PLANNING TO STIMULATE TECHNICAL PROGRESS SOUGHT

Moscow VOPROSY EKONOMIKI in Russian No 5, May 80 pp 32-41

[Article by K. Yesimov: "Improvement of Planning and Stimulation of Scientific Progress"]

[Text] The large scale and new conditions for the development of the economy place serious demands on the structure and technical level of production, on the utilization of current productive capacities, and on labor and material resources. In recent years in a number of industries and rayons of the country experiments in the improvement of planning and in the reinforcement of the role of economic levers and stimuli were conducted at individual enterprises.

Based on the conclusions of these experiments the decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Reinforcing the Action of the Economic Mechanism for Improving Production Efficiency and Work Quality" noted measures for improving the level of planning operations for the national economy, increasing the effectiveness of capital outlays and developing cost accounting. Full consideration of the achievements of science and technology in the plans of economic and social development is envisaged among the measures for improved planning, i.e., their rapid realization as modern instruments and subjects of labor in modern work processes, and means of transport and communication by creating and introducing appropriate systems of machines and devices.

In order to solve these problems a number of organizational and economic measures, which will assure a harmonious integration of production indicators and indicators for the introduction of science and technology, have been developed. Among the important tendencies here one should note improvement in the work of scientific and technical forecasting, and the change in the system of indicators of the introduction of modern technology at all levels of management. This means that the results of implementing scientific and technical measures are becoming most important and

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fundamental in all departments of the national economic plan, i.e., the achievements of science and technology will be thoroughly considered.

Now, when a complex program of scientific and technical progress is the basis for developing a national economic plan and is a component part of it, a higher degree of reliability in the entire system of scientific and technical forecasting is required (forecasts for industries, complexes of interconnected industries, and finally, the program itself), which are developed by scientific organizations of the USSR Academy of Sciences, the GKNP [USSR Council of Ministers State Committee for Science and Technology] and by the ministries and departments. It is important to improve analysis of the possibility (in time periods and scales) for application of modern principles in the instruments and the objects of labor and of technology and to create conditions for relating the degree of effectiveness of the scientific and technical solutions which are realized through the resources of society. There must also be an assurance of conformity between the technical planners and the characteristics of modern technology, the methods of organization production and labor and the indices for reduction of unit expenditures of labor, material resources, and capital outlays for the entire period of the program's existence, especially for the first 5 years.

Based on comprehensive consideration of the achievements of science and technology in the national economic plan, in the appropriate sectors of the five-year plans for economic and social growth there have been established: quotas for the growth of production in the highest quality category and for its other indices; quotas for reducing the use of manual labor; and quotas for reducing the norms of material resource consumption. In turn, such indices of the state plan for science and technology, such as assimilation and introduction of modern, highly effective technological processes and output in the newly introduced enterprises and for the expansion and redesign of existing enterprises, and they are considered in the indices for capital construction. For this purpose appropriate measures have been taken in the designing of new enterprises and in the redesigning of existing enterprises. The inventory of goods produced should be periodically reviewed in order to take into consideration the changes occurring in technology. Representatives of the consumers of goods, and in some cases, of the USSR Ministry of Trade and of ministries which are responsible for the technical level of the products in question should be encouraged to participate in the review board of the projects.

There are also plans for completely developing and bringing on line in 1979-1983 subsystems for monitoring the technical level of quality of goods produced in the industries' automated control systems which will assure its favorable comparison with improved Soviet and foreign models. In setting standards and technical conditions for the requisite products in enterprises which are being expanded and redesigned, the USSR Council of Ministers State Committee for Standards should not allow these products to be lower in quality than other Soviet and foreign samples.

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Composition and contents of the plan for developing science and technology have been changed, and the indices for introduction of the new technology have been defined. There is increased importance for the overall target of scientific and technical programs, which now must, as a rule, be completed by organizing modern production forces, i.e., by introducing the results of research and development to an optimal degree, and not be checking the scientific and technical solutions at the main facilities. First the index of the effect of introduction of scientific and technical measures is introduced as established, and then the importance of the indices of the technical level of production and products being produced is reinforced.

In the next 10-year period one should consider the immediate directions of technical progress in developing scientific and technical programs, as investigations conducted by scientific organizations have indicated, to be the following:

- an assurance of a practical transition to the creation, production and expanded use of systems and complexes of machines, and also of automatic production lines for mechanization and automation of all stages of production processes, from the production of raw materials to the output of finished products based on modern and highly advanced, primarily continuous and combined technologies;
- a significant increase in development of techniques which eliminate manual labor and heavy operations;
- the introduction of technology and techniques which will assure an increase in the level of electrification and electrical energy support of labor and at the same time a maximal economy of the fuel, energy and raw material resources, and also of all kinds of materials. especially ferrous and non-ferrous metals (no-waste and low-waste technologies);
- the continuation of projects for economically based improvement of the unit capacity of machines and aggregates, of workers and transport speeds, speeding up of work schedules, and for increasing the reserves of machines and equipment in assuring the reliability and economy of operations;
- the improvement of machines and equipment relative to special operating conditions and the development of multifunctional machines;
- the automation and optimization of control of individual machines and systems of machines;
- the widespread introduction of chemical processes and materials into all branches of production in the area of public services.

Basic difficulties in resolving complex scientific and technical problems occur during the transition from one stage of the cycle "research-production-application" to another, especially if the executors of projects

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at these stages are the organizations and enterprises of different departments. There are varied and complex communications which are involved in creating basically new equipment and technology, for which there must be an organization of modern institutions or a reorientation of existing scientific and design institutions, industries, branches and control elements at various levels, setting aside huge financial and material resources, and highly skilled scientific and production personnel. Programs for resolving scientific and technical problems are needed to assure a required linking of projects between different executive agencies and the combination of projects for the entire cycle "research-production-application."

Charts of the technical level and calculations of the economic effect will be developed and presented for each facility included in the program. This will enable one to avoid including in the plan non-relevant studies and developments which do not assure a radical improvement in the technical and economic parameters of the new facility being created in comparison with the best Soviet and foreign analogs, areas and scales of intended application, patent rights, and limit (maximally limiting) costs are presented in the charts.

One of the important conditions for assuring ultimately high social and economic results from the introduction of scientific and technical achievements is the consecutive application in planning of the adoption of new technology for the system as indicated for the technical level of production and the goods produced. This system should include a set of quotas for the purpose of reinforcing the action of the plan for increasing the technical level of production and product quality, and on this basis it should assure the growth of labor productivity and economy of resource utilization. Such quotas were first established in the 10th Five-Year Plan, but still have not had an adequate effect on improving the technical level of production, insofar as they do not reflect all of the most important tendencies of technical progress in the branches of the national economy, and consequently they have not achieved their promised efficiency due to realization of these tendencies.

In order that the indices for the technical level of production and quality of goods produced optimally effect the realization of the main achievements of science and technology, it is necessary to assure that these indices influence the basic aspects of technical improvement of production: change in the quality structure of goods being produced; increase of the level of the technical base in industries, important production areas and improvement of the degree of utilization of equipment; assimilation and introduction of basically new processes and equipment at an optimal level; reduction of the amount of manual labor, especially in heavy, dangerous and monotonous operations by the application of systems and complexes of machines and processes; reduction of the material costs of the instruments, means and objects of labor.

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In machine tool construction, for example, one of the main directions in organizational changes is the increase in the relative significance of machines and equipment for pressure shaping, which allows one to manufacture articles with less or without metal waste. Through a system of planned quotas for the production of intermediate products by advanced methods and equipment it is necessary to assure fulfillment of the metal utilization factor, which was first introduced in 1980 for machine construction. In subsequent years it is important to raise this index. The qualitative structure for the output of metal-cutting lathes is being changed. In the period 1970-1978 the overall amount increased by 17 percent, and for lathes with CHPU [Numerical Programming Control] it increased by a factor of 4.6, for automatic production levels for machine construction and metal working it increased 39 percent. Reproduction of mechanized complexes is increasing in machine construction for the mining industry. There has been a reorganization of the structure for producing cargo vehicles; the production of huge capacity dump trucks, tractor and trailer rigs, coal hauling vehicles etc. is sharply increasing.

We could introduce many examples of the effective solution of organizational problems. The reorganization of the existing capacities and industries of the national economy, however, still lags behind the forecasts for development of production. Evidently, organizational policy must be directed at assuring higher rates in the utilization of the achievements of scientific and technical progress.

In order to improve the technical level of production, the planning of which is so crucial under modern conditions of economic development, the ministries and departments must also provide quotas for improving the generalized indices of quality. For example, application of the index of average tire wear in the petroleum and chemical industry, the average grade of cement in the construction materials industry, the average diesel operational reserve for groups in the machine building industry, the index of average iron content in technical grade ore in ferrous metallurgy and the index for average amount of nutrients in mineral fertilizers in the chemical industry will enable one to determine a set of measures in achieving high technical and economic indices for production in various branches of the national economy.

In all ministries which have gone over to the new system of planning, finance and economic stimulation of products based on modern technology, the systems for branch industry attestation of the quality of goods have been adopted. A single index of the technical-economic level and quality of articles for the ministry, enterprises and associations--the volume of goods produced in the highest quality category and its proportion in the total production volume have been put into practice in planning on the basis of industry attestation. The quality level of goods being produced for all industrial ministries has become one of the basic indices for evaluating their productive-economic activity and an important fund generating index.

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This has promoted an increase in goods of the highest quality category, the volume of which has increased by a factor of 2.6 in relation to the national economy in the four years of the Tenth Five-Year Plan. By 1 January 1980 the state Mark of Quality was awarded to 75,300 articles, of which about 53,000 were awarded to consumer goods. In this same period the number of production associations, enterprises, and organizations which produced goods with the state Mark of Quality increased almost two-fold. The output of goods in the second quality category was cut in half in this period. In a number of sectors the rates of increase were higher for the output of goods with the Mark of Quality. For example, in Minkhimprom [Ministry of the Chemical Industry] the volume increased by a factor of 3.2 in comparison with 1975.

An important direction for improving the technical level of production is the introduction of equipment with large (optimal) unit output using advanced process flow diagrams and an improved degree of process continuity with the use of active catalysts and with the complex use of raw materials and heat released in chemical reactions. The approval of such goals in the plan commits one to work more actively on improving the pattern of the real share of basic capital, because the cost per unit produced for this capital and the specific metal consumption is 5-12 percent lower than for equipment with a lower unit output.

In the Tenth Five-Year Plan the opening of installations for weak nitric acid with an output of 400,000 tons per year should increase almost five-fold in comparison with the Ninth-Five-Year Plan, and the number of installations with an output of 680-700,000 tons per year should increase more than fourfold. The first installations for hydro-purification of petroleum with capacity of 2-2.5 million tons per year started operating at the end of the Ninth Five-Year Plan, and in the next five-year plan their number increased significantly. Transition to the production of combined installations for petroleum refining is also being completed. In 1971-1975 less than 10 percent of the total amount of petroleum refining equipment was produced for such installations. The growth and production of equipment with large unit capacity for ammonia, ammonium nitrate and other large-capacity plants allowed us to increase the output of goods at these advanced plants in 1978 in comparison with 1975 by a factor of 1.5-3.

Establishing quotas for expanding the use of basically new and advanced technological processes, and also for increasing the level of mechanization and automation of production is of great importance for increasing the technical level of production. This can be shown from the example of plasma-mechanical methods of processing (PMO). Plasma, like an electron beam or a laser, is a modern highly concentrated energy source. The great technological probabilities of plasma have attracted increasing attention from researchers and specialists in a number of enterprises in recent years. Experience in the application of plasma in cutting, welding, mechanical

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processing, spraying, and fusion of metals has confirmed its advantages because softening the cutting surface by a plasma arc creates conditions for multiplied growth of labor productivity. During plasma softening of a surface to be machined the strain on the cutter is reduced by a factor of 1.5-1.8, and its surface life is increased by a factor of 6-8. Factory tests of PMO have shown that the cutting rate for titanium alloys, high-manganese content stainless steels, alloy steels, heat-resistant and heat-stable steels is increased by a factor of 5-30, and for low-carbon and low-alloy steels it is 2-3, and for low-grade coatings it is 4-7.

Preliminary evaluation of the effectiveness of this advanced technological process at Sverdlovskaya oblast' plants has shown in the majority of cases that labor productivity increased severalfold. Thus, at the association "Turbomotornyy zavod" during machining of gas turbine blades using plasma a labor productivity increase of approximately tenfold is expected, and at the plant "Uralgidromash" in manufacturing parts of sump pumps it increased more than threefold. At the association "Uralsmash" the new technology can be applied in approximately 30 large units. It is figured that the savings obtained is 10-15 million rubles. The demand for heavy-duty and customized units has been reduced by not less than 60 units, for whose maintenance more than 250 highly skilled workers are required. Moreover, the transition to plasma-mechanical machining makes it possible to substantially increase the production of new materials, strengthened by surfacing with wear-resistant coatings at "Uralsmash." At the association "Uralsletrot'yazhmash" and "Uralskhimmash" more than 20 heavy-duty and customized lathes are in the process of being equipped with plasmatrons.

According to the data of Minelektrotekhprom [Ministry of Electrical Engineering Industry and Power Machine Construction] in 1985 there can be a national economic result of about 350 million rubles for total capital expenditures of approximately 45 million rubles from the widespread introduction of PMO. At the present time a systematic program for introducing plasma-mechanical machining into the national economy has been approved. In 1980 up to 1000 plasmatrons will be produced, and the production of these units will increase severalfold in the future.

A second line of the axle rolling mill "250" on which hollow axles for railroad cars will be manufactured for the first time in the world was recently initiated at the Dneprodzerzhinskiy Metallurgical Plant of Minchermet [Ministry of Ferrous Metallurgy]. In one year this plant will save 50 thousand tons of high-grade metal. An increase in the carrying capacity of the cars will be possible due to an increase in axle strength. Several dozen piece rolling mills began operation in the industry. This highly efficient example of practically wasteless technology should receive widespread expansion both in metallurgy and in machine construction during the next five-year plan.

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Manufacturing parts in the machine construction industry by the method of powder metallurgy sharply increases labor productivity and reduces capital expenditures. Powder materials are also used for applying coatings by the method of plasma spraying and fusion for joints and parts of machines. This increases their service life and their corrosion and erosion resistance. Powder solders for soldering a compound instrument permit one to reduce the consumption of high-speed steel by a factor of 4-6 and of solid alloys by a factor of 1.5-2. Powders of high-speed steel are used for manufacturing a shaped high-speed tool, which makes it possible to increase its service life by a factor of 3-4.

The possibility of purposeful efforts for accelerating the introduction of basically new and highly advanced technology by a system of indices of the technical level of production is obvious. Therefore, a persistent search for new indices, which reflect advanced technical solutions, is an urgent matter to be considered in the plan.

Indices of the improved level of mechanization and automation of production are a component part of a system of indices of the technical level of production. They should include quotas for the widespread application of systems and complexes of machines in production and, on this basis, quotas for mechanization and automation of the entire production cycle. Consistent attention now and in the future should be given to mechanization of production, where a significant number of workers are still engaged in heavy manual labor, as in lumbering, underground extraction of coal and ore, hoisting and transporting operations, and in construction and agriculture.

In the current five-year plan quotas have been established for comprehensive mechanization of the process of felling operations with complete elimination of manual labor, and also for mechanization of individual operations--felling trees, hauling logs, removing branches from tree trunks, and automating the crosscutting of logs. This enables one to compute and consider in the plan the need for machines and mechanisms for the given processes, and to relate indices of the level of mechanization of tree felling operations to the final index in the lumber industry--the annual overall output for one worker engaged in lumber operations.

The significant possibilities for improving the level of mechanization should be used in loading-unloading and warehouse operations in different sectors of industry and transportation by expanding the production of the means of mechanization and rigging with electric motors (with improved load capacity and maneuverability), with hydraulic distributors and with a series of integrated suspension devices. In addition, for effective mechanization of these processes there should be a re-examination of the method of packaging and loading products by the producing enterprises in order to assure a savings of time and effort in subsequent unloading, re-loading, transportation and preparation for use by the consumer. Here we

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refer to a well thought-out system of measures for the entire cycle of packaging, loading, unloading, transportation and warehouse operations, which should be considered an integral part in designing systems and complexes of machines for these purposes and also for the state and industry standards.

An important program is being carried out in a number of industries, particularly in making, for the elimination of monotonous and unattractive manual labor. For example, the Petrodvoretskiy clock factory, which makes more than four million men's watches per year, in cooperation with the Moscow SKB [Special Design Bureau] for watch and tool machine building has conducted projects for the mechanization and automation of mechanical machining. For mechanization of the assembly processes, which comprise more than 40 percent of the labor involved in manufacturing watches, special lines and integrated small-scale automatic manipulators (robots) with extensive technological possibilities have been designed and manufactured.

Indices of the reduction of materials used in production and fuel consumption are of great importance. An index for consumption of conventional fuel per one kWh of electric power, which has been established for electric power engineering, should be achieved chiefly by the use of efficient power equipment operating at supercritical steam parameters. Reduction of this index to 327 g in 1980 as opposed to 340 g in 1975 can assure an economy of more than 11 million tons of conventional fuel. Such indices as the consumption of coke per 1 ton smelted pig iron and the consumption of steel ingots per one ton of rolled steel are important in ferrous metallurgy. Their reduction depends on the technology for preparing a charge, improving the process of domain, steel smelting and rolled steel production, and on the level of newly introduced metallurgical equipment.

Indices of the reduced consumption of ferrous and nonferrous metals are very important in a number of industries and enterprises which require large amounts of these scarce metals. A purposeful project in this area, determined by comprehensive programs and a system of the indices of the technical level of production, can yield tangible results. Thus, specialists of Giproleghprodmontazh [expansion unknown] together with builders of Minmontazhspeksstroy [Ministry of Erection and Special Construction Project] developed and introduced glass pipelines with an armored layer made of a special plastic glass on the outer side of the pipe in place of pipes made of ferrous and nonferrous metals and alloys. The service life of the glass pipeline is 15-20 times greater than that of metallic ones. During this five-year plan more than 15,000 kilometers of glass pipelines should be laid which will result in a savings of 100,000 tons of metal and a shared economic result on the order of 250 million rubles.

It should be noted that the system of indices of the technical level of production is dynamic. Therefore when dealing with a comprehensive program

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It should be noted that the system of indices of the technical level of production is dynamic. Therefore when dealing with a comprehensive program of scientific and technical progress, which is fine-tuned before the beginning of each five-year plan, appropriate refinements must be injected into the indices. Thus, in the Ninth Five-Year Plan an index for the introduction of lathes with CHPU [Numerical Program Control] was introduced. The expansion of production and the application of these lathes assured the creation of sections for automated machining of parts which are controlled by a single computer. The effectiveness of using lathes in such an organization of projects has increased by a factor of 2-3. Automated sections of lathes with CHPU controlled by a computer can be equipped with robots and manipulators which enable one to automate the transport of parts between lathes in conformity with the technological work flow pattern. Obviously, it is now appropriate to introduce the index of the number of sections with automated machining of parts by lathes controlled by a single computer (with indication of the number of lathes) in place of the index of assimilation of lathes with CHPU. It is most efficient, in our opinion, to also insert the index for assimilation of robots and manipulators which are used in heavy and dangerous operations, etc.

The decree "On Improving Planning and Strengthening the Action of the Economic Mechanism for Improving the Effectiveness of Production and Work Quality" provides for a number of organizational and economic measures for improving the technical level of production and goods produced. Among the organizational measures are realization of systematic evaluation of the level of equipment produced, extra-departmental appraisal of the technical and economic indices of the goods created and of the technological processes from the stage of technical assignments to end results, and improvement of operations in the area of standardization and unification. A project for re-examining obsolete standards for machines and equipment will be conducted by the USSR State Committee on Standards of the Council of Ministers and by ministries and departments. In addition to qualitative features requirements which will assure a reduction in the weight of articles, the new standards require a reduction of fuel and energy consumption and unification of parts and assemblies of devices. A program of operations for standardization and specialization of the production of articles of universal application in machine building will be undertaken.

It is also necessary to plan the creation and introduction of unified inter-industry systems of equipment standards, planning and accounting and other kinds of documentation, systems of classification and categorization of goods produced, and a system to insure unity of measurements in production based on strict requirements. There are still many shortcomings in this project. There are few standard technological processes and the level of standardization of equipment and accessories is inadequate. Improving work in this area should assure improvement of the technical and economic level of new developments and the effectiveness of production.

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Scientific research, design, technological and other organizations, testing (experimental) enterprises, scientific industrial and industrial associations (enterprises), and commercial ministries will convert to a cost accounting system for organization of projects for the creation, assimilation and introduction of new technology based on orders or contracts. The basis of this system is found in the end results: the introduction of results of projects and the economic result in relation to which funds for economic stimulation, material incentives and rewards for workers in these organizations will be generated.

Correlation of the operating experience of a number of ministries (Minelektrotekhprom, Mintyazhmash, Minkhimprom, etc.) according to such a system of planning, finance and economic stimulation for the creation, assimilation, and introduction of new technology is evidence of its progress and influence on the results of production. For example, at the Ministry of Heavy and Transport Machine Building following the conversion of its scientific, design, and technological organizations to the new systems for planning, finance and stimulation of the introduction of new technology, the time periods for creating and introducing new technology were reduced by 20-30 percent.

The time periods for conducting and introducing developments into production were also reduced at Minkhimprom. For example, a huge unit for the production of ammonia at the Nevinnomyskiy production association "AZOT" was introduced in three months, at the Severodonetskiy and Cherkasskiy production associations "AZOT" it was done in eight months instead of the usual eighteen, and at a large plant for the production of ammonium nitrate it was assimilated in five months instead of nine.

At ministries which have converted to the new methods of planning, finance and stimulation of the introduction of the new technology, incentive funds have begun to be generated basically due to the inflow of capital from enterprises following the completion of projects for the creation of technology and realization of their results in production. The amount of the funds which have been supplied is in direct relation to the normal results of the work of the teams of developers and workers of the enterprises, which are assimilating the production of new technology. Results of research and projects have had a significant economic impact in the system of incentives, and in fact, such results have become the determining criteria in evaluating the activity of scientific organizations and enterprises for the creation, assimilation and introduction of new technology.

The positive influence of the new system of economic stimulation of scientific and technical progress is revealed in the growth of economic efficiency of investigations and studies, in an increase in the amount of newly introduced articles, in the increased amount of capital used as incentives for the creation, assimilation and introduction of new technology. For example, at Mintyazhmash during 1972-1977 the economic effectiveness of

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their efforts increased by a factor of 2.5, the funds available for economic stimulation have increased by a factor of 2.1, and the number of new assimilated articles has increased by a factor of 2.4.

The creation of funds for economic stimulation of associations (enterprises) is now regarded chiefly in relation to fulfillment of qualitative indices of work. Higher standards for the formation of economic stimulation funds are being established by the significant increase and output of new, highly efficient products (above all products in the highest quality category).

The decree on improving planning provides for a number of measures for overcoming the contradictions between quantitative and qualitative indices. The cost of operations (including the standard profit) of a commercial nature, which are producible due to capital of a single fund for development of science and technology will be taken into account in the total volume of goods produced. This will reduce the contradiction between the fulfillment of volume indices by associations and enterprises and the expenditure of capital for the goals of assimilations, and it will increase their interest in rapid realization of projects based on the new technology.

Increases in the wholesale prices for new production and technical purpose goods which are regulated by the decree must operate effectively. Seventy percent of the additional profit obtained from realization of the new highly efficient products goes to the funds for economic stimulation and 15 percent goes into a single fund for the development of science and technology. It has been found that the sum of the increases is not taken into account in the plan, but the evaluation of fulfillment does consider them. A system of allowances which are figured in the budget is inserted for the output of obsolete goods. The decree envisages 150 percent increase in the size of increases in the wholesale prices for the new, highly efficient goods and for goods with the Mark of Quality if the production of these goods is based on efforts which are acknowledged as in the established sequence by inventions or discoveries. This will heighten the interest of collectives of enterprises in using inventions and it will promote the growth of production efficiency. A decision has been made to maintain the wholesale prices for goods produced throughout the five-year plan at the former level by using inexpensive kinds of materials in production in comparison with the ones that have been used. The wholesale prices for the new articles with less material costs will be set with preservation of profit margins produced by the previous goods (replaced) and not lower than the standard of profitability. Maintaining wholesale prices at the former level will encourage the appearance of additional reserves and a savings of materials.

Under the prevailing system of planning and stimulation of technological progress, associations (enterprises), fearing a deterioration in the indices of their operations, have gone slowly on replacing obsolete articles with new ones, or in expanding their inventory of goods. This has led to

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a reduction in the rates of the turnover of goods produced and production efficiency as a whole in the national economy. The decree permits ministries and departments to introduce changes into the annual plans of production associations (enterprises) based on their suggestions, if the total number of articles produced in other indices decrease in comparison with the established trends in connection with utilizing and increasing the output of highly efficient goods for production and technical purposes for new commodities of high quality for the population. But in this case the production association (enterprise) must at the same time redefine the economic agreements with the consumers. In cases where the indices are deteriorating (for the reasons stated above) in comparison with the ones established for the ministry, department or union republic as a whole, the required changes should be in harmony with the USSR State Plan. Such a decision allows room for rapid assimilation of production and introduction of new highly efficient goods by encouraging an overall increase in production efficiency.

The planning and economic agencies have started to realize the decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Strengthening the Action of the Economic Mechanism for Improving Production Efficiency and Work Quality." The USSR State Planning Committee, GKNT [State Committee of the Council of Ministers of the USSR for Science and Technology], the USSR Academy of Sciences and USSR Gosplan [State Committee of USSR Council of Ministers for Material and Technical Supplies], as was noted above, have confirmed a number programs based on which a set of quotas has been established in the appropriate sections of the national economic plan. A project for realization of programs for construction of high pressure gas pipelines has been completed. For the first time indices such as radiation treatment of varnish coatings on articles made of wood and veneer, radiation treatment of grain elevators, advanced methods for manufacturing steel billets, etc. have been used as indices of the technical level. Work on preparing new programs and designing new indices of the technical level of production of goods produced is continuing.

Measures noted by the decree of the CPSU Central Committee and USSR Council of Ministers will create a new impulse to accelerate scientific and technical progress, which will assure faster rates for reducing the amount of labor and materials needed for production and, consequently, an improvement of its effectiveness.

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